The Impact of Non-Cognitive Characteristics on the Higher Education Choice-Making: An Economist Perspective

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Abstract

The article presents a review of literature systematizing findings on the contribution of non-cognitive skills to higher education choice-making. The concept of higher education choice-making in this paper embraces the decision to embark on a college degree, the probability of successful degree completion, the choice of academic discipline, and other related aspects. A priority focus is given to publications in economics since the economic approach differs a lot from approaches in other social sciences. In addition, the article explores the methodological characteristics of non-cognitive skills research in economics. The results of literature analysis point to the relevance of non-cognitive skills in explaining individual educational choices and allow drawing some inferences for education policy.

Keywords

higher education, higher education choices, higher education choice-making, human capital theory, non-cognitive skills, the Big Five personality traits.

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Higher education has been on the radar of economists for a long time. This should not come as a surprise: higher education choices are decisive for further career and socioeconomic trajectories. However, this interest also has a historical background. By the middle of the 20th century, the rapid economic growth during the post-war reconstruction period, the emergence of new manufacturing technologies, and the attempts to establish national social welfare states which increased social expectations in developed countries had led to a surge in population's demand for higher education and at the same time in the labor

market's demand for skilled labor. Technological innovations enhanced the value of higher education as a driver of innovative socioeconomic development. Naturally, the growing social demand for higher education triggered a multifold increase in government expenditure on this sector, which had to be clearly substantiated. A search for substantiation promoted research on returns to education, and the human capital theory put forward in the 1960s [Becker 1964] became one of the fundamental theoretical frameworks for explaining effectiveness of investments in education.

Human capital is the stock of knowledge, skills, and competencies acquired by an individual. From the perspective of human capital theory, the value of education consists in building it up, i. e. in developing the skills that will enable an individual to enhance their job performance and earn more. A long debate led economists to a conclusion that from an individual's point of view, higher education is not a consumption good but an economic one, which implies receiving some return to it in the future [Lazear 1977]. Empirical studies at the micro-level confirm a positive rate of return to education, postsecondary education in particular (for a review, see [Psacharopoulos, Patrinos 2018]). In addition to individual rates of return, an increase in the level of educational attainment in a society promotes technological and innovative development, improves labor productivity, and reduces poverty and crime. Finally, empirical studies indicate a significant contribution of education in the long-term growth of national economies (for a review, see [Barro 2001]), which found its way into macroeconomic theories of endogenous growth [Romer 1994].

Evidence of positive returns to education at both micro- and macro- levels inspired optimism and confirmed the need for government investments in the sector, thereby strengthening the trend for mass distribution of higher education. However, as the percentage of population with college degrees was growing, economic growth was slowing down, so the optimistic expectations had to be readjusted. Ability is the main factor of bias in the assessment of returns to education, as it affects productivity, the likelihood of going to college, and wages at the same time. Proponents of the job market signaling model, which competes with human capital theory [Spence 1973], tend to absolutize ability: denying the contribution of education to productivity, they argue that a college degree sends a signal to employers about the candidate's innate capabilities and, hence, higher productive capacity. In an effort to correct the initial estimate bias, twin studies were initiated that allowed controlling for shared family environment factors and genetically predetermined abilities. This literature [Griliches 1977; 1979] as well as later publications allowed inferring with great certainty that the upward bias in the estimates of returns to education caused by differences in ability is balanced by the downward bias attributed to educational attainment measurement errors, so the initial estimates of returns to education reflected the situation quite accurately [Card 1999].

Human capital is a multilayer concept that is hard to measure. As education contributes to the development of various skills, researchers have come to pay attention not only to overall returns to educational attainment but also to returns to skills acquired in the process of learning. Originally, human capital research was focused on intelligence and intellectual competencies (ICT skills, occupational skills, knowledge of foreign languages, etc.), which came to be known as cognitive skills. Empirical studies consistently indicate positive associations between cognitive performance and educational and labor market outcomes [Lin, Lutter, Ruhm 2018]. However, skills and abilities are not restricted to intelligence. For a long time, economic analysis ignored the possible significance of other characteristics that are not directly related to intellectual abilities but affect behaviors nevertheless. As an emphasis of their distinction from cognitive abilities, these characteristics came to be referred to as non-cognitive skills — a notion that embraces a broad category of individual psychological qualities inseparable from the process of learning and working.

The growing interest in non-cognitive skills has to do with several factors. First, understanding of how non-cognitive skills work allows measuring the effectiveness of classical education programs designed to increase intelligence. Nobel Laureate James Heckman, who has become a pivotal figure in economic analysis of non-cognitive skills, underlines that the preoccupation with cognition and academic "smarts" as measured by test scores to the exclusion of social adaptability and motivation causes a serious bias in the evaluation of many human capital interventions [Heckman 2000]. In addition, it has been established that education programs fostering positive non-cognitive skills in the form of habits and behavioral patterns have longer-term positive effects on social outcomes, from higher earnings in adult life to lower crime participation, and thus can be an effective tool for breaking the intergenerational cycles of poverty. If an individual's personality determines their choice of the level, field, and quality of education to obtain, differences in non-cognitive characteristics may limit the potential of education as a mediator of social mobility, separating students from well-off families from those who grew up in less economically advantaged settings. Findings confirming the effectiveness of programs designed to promote non-cognitive skills mostly come from preschool and elementary school research (for a review, see [Heckman, Jagelka, Kautz 2019]), while effectiveness of such educational interventions at later stages of life, especially in college, remains an open research question.

Second, the growing interest in non-cognitive skills is triggered by changes in the labor market landscape. Digitalization that has reached every sector of economy is rapidly transforming the demand for skills [Edin et al. 2017]. As computerization advances, developed countries witness a decrease in the proportion of routine tasks but at the same time an increase in the percentage of jobs that require a combination

of cognitive and non-cognitive skills, including communication and adaptability [Deming 2017].

Non-cognitive skills are valuable not so much in the context of higher education per se as in the context of labor markets. Relevance of non-cognitive skills has been repeatedly demonstrated in empirical studies over the last 10–15 years. It transpires that non-cognitive characteristics, along with cognitive ability, correlate with wages [Brunello, Schlotter 2011; Gensowski 2018], (un)employment probability [Cuesta, Budria 2017], and other indicators of wellbeing [Krishnakumar, Nogales 2020]. Findings from Russia-based studies [Maksimova 2019; Rozhkova 2019; Gimpelson, Zudina, Kapelyushnikov 2020] demonstrate that non-cognitive skills play a significant role in the Russian labor market and that returns to them are comparable to returns to other components of human capital. Productivity associated with possession of specific personality traits is one of the possible ways of generating such returns [Cubel et al. 2016].

Economic publications examining the relationship between non-cognitive skills and education are comparatively few, although education is the potential mediator among psychological factors, productivity, and labor market. The costs of college attendance include so-called "psychic" costs associated with stress and deadlines, which cannot be avoided even by students with higher cognitive levels. The magnitude of psychic costs depends on an individual's personality traits which determine how easily they can navigate college life [Jacob 2002]. In particular, psychic costs explain why adolescents who would economically benefit from education decide not to pursue it [Cunha, Heckman, Navarro 2005; Heckman, Stixrud, Urzua 2006].

Research on the associations between higher education choices and non-cognitive skills is only in its nascent stage, and the Russian literature is no exception. The issue has been heavily addressed by psychologists and educators [De Raad, Schouwenberg 1996], but their approaches are different in many ways from the one used in economics. This article seeks to summarize the existing economic literature on non-cognitive skills in higher education and thereby lay the foundation for future research on Russian samples.

1. What Cognitive and Non-Cognitive Skills Are and How They Are Measured

Broadly speaking, cognitive skills are understood as intellectual abilities of an individual, including the ability to count, read, and write (basic cognitive skills) as well as to reason abstractly and solve non-routine problems (higher-order cognitive skills). In psychology, there is a generalized factor of intelligence *g*, divided into discrete factors of fluid and crystallized intelligence [Cattel 1963]. Fluid intelligence involves memory skills and the rates of thinking and learning. It peaks at the age of 25 and is measured by IQ and verbal reasoning tests. Crystallized intelligence encompasses cultural experiences and learned procedures and knowledge. It accumulates throughout an individual's

life and is measured by standardized tests, including achievement tests.

Non-cognitive skills in economics (same as personality traits in psychology) are defined as the relatively enduring, patterns of thoughts, feelings, and behaviors that people exhibit in similar situations across time [Roberts, Davis 2016]. According to another definition, the term non-cognitive skills describes the personal attributes not thought to be measured by IQ tests or achievement tests [Kautz et al. 2014]. Meanwhile, high cognitive test scores are explained not by intellectual abilities alone but also by motivation, effort, and the personality traits that underlie them [Borghans, ter Weel, Weinberg 2006]. For this reason, the contribution of cognitive skills in economic growth, measured by IQ tests or educational attainment, can be explained to some extent by non-cognitive factors as well [Brunello, Schlotter 2011]. Since non-cognitive characteristics can predict the acquisition and use of soft, or socioemotional, skills (leadership, teamwork, time management, etc.), these two constructs are closely interrelated, though not identical.

Empirical measurements of non-cognitive skills in economics are centered on the established psychological theories. Unlike cognitive skills that are measured by tests, non-cognitive skills are more often assessed based on self-report behavioral questionnaires. Empirical research requires an instrument that meets a number of requirements: it should be valid (i. e. actually measuring the phenomenon in question), concise, and easy to understand. The Big Five, renowned as the most influential taxonomy of personality traits [John, Srivastava 1999], has become such instrument for psychological and economic literature. The Big Five taxonomy is based on a lexical approach which posits that if a trait is significant or prevalent enough, it should have a lexical descriptor in the language [Goldberg 1990]. Repeated clustering of words denoting the entire variety of personality traits yielded five broad categories allowing to describe a person: conscientiousness, openness to experience, extraversion, agreeableness, and neuroticism. Using the Big Five trait taxonomy, researchers have found strong associations between students' psychological traits and academic performance [Poropat 2009].

Conscientiousness is recognized as the most significant personality trait for academic achievement. It reflects the propensity to follow socially prescribed norms and involves dutifulness, self-discipline, order, and other parameters affecting job performance. Psychological studies show that achievement striving and self-discipline together with dutifulness, expressed in a high level of conscientiousness, are associated with better performance in undergraduates [Gray, Watson 2002], this association being mediated by positive study habits and attitudes [Delaney, Harmon, Ryan 2013]. Openness to experience implies high inquisitiveness and measures the degree to which a person needs intellectual stimulation, change, and variety [Borghans, ter Weel, Weinberg 2008]. Openness to experience is also characterized by

high levels of intellectual curiosity, which may predict academic choices [von Stumm, Hell, Chamorro-Premuzic 2011]. Extraversion embraces interpersonal communication, sociability, talkativeness, and positive emotionality [McCrae, John 1992]. Some studies report a negative correlation between extraversion and academic outcomes in higher education [Noftle, Robins 2007]. Agreeableness measures an individual's tendency to act in a cooperative manner. A small positive association between agreeableness and academic achievement was found, which is probably mediated by lecture attendance rate [Delaney, Harmon, Ryan 2013]. In addition, more agreeable individuals are more likely to engage in altruistic behaviors [McCrae, John 1992] and can make better team players. Finally, neuroticism reflects the level of emotional instability, anxiety, and impulsivity. On the one hand, emotionally stable students can use their stress coping skills to learn more effectively [Kaiser, Ozer 1997]. On the other hand, students who are higher on neuroticism tend to spend more hours on additional study [Delaney, Harmon, Ryan 2013].

All the other personality traits are either part of the Big Five domains or correlated with them. In particular, such valuable characteristics as leadership and motivation are not included in the stated categories explicitly but overlap with them partially: achievement striving, one of the facets of motivation, is recognized as a component of agreeableness, while leadership implies a high level of extraversion [Borghans, ter Weel, Weinberg 2008]. Although the Big Five is the most popular instrument in the economic literature, the choice of measure often depends on data availability [Brunello, Schlotter 2011]. Such psychological constructs as locus of control (Rotter's scale) [Heckman, Stixrud, Urzua 2006; Cobb-Clark, Schurer 2013], self-concept, and motivation [Saltiel 2020] are used as alternatives to the Big Five taxonomy.

Estimates of the relative effects of personality on socioeconomic outcomes may be biased downwards due to the measurement errors associated to self-reporting, which remains the key way of collecting information on non-cognitive skills in large surveys [Brunello, Schlotter 2011]. To answer a psychological question, respondents need to compare their own behavior with their perception of a social norm or a cultural context, so they generally try to avoid extreme responses. However, there is experimental evidence supporting validity of self-report personality tests. Participants filled out the Big Five questionnaire twice: the first time, they were given neutral instructions, and the second time, they were asked to imagine a specific setting and adjust their answers accordingly [Ziegler et al. 2010]. Results showed validity for self-ratings of personality, and "faked" answers did not affect the predictive validity of the Big Five domains relative to academic performance.

Self-report surveys are the most widespread yet not the only way of measuring non-cognitive skills for further analysis. School grades are another measure—a rather controversial and imprecise one, as it

is affected by both cognitive and non-cognitive skills. Students that are more open to experience devote more time to study and show better academic outcomes [Brunello, Schlotter 2011; Heckman, Jagelka, Kautz 2019]. Furthermore, there have been behavioral assessments of non-cognitive skills based on teacher ratings, extracurricular activities, independent learning, and participation in school clubs [Lipnevich, MacCann, Roberts 2013].

A key concept in economic analysis is preferences underlying an individual's decisions, including educational choices. For instance, a lower value (i. e. higher discounting) of the future renders investments in education less attractive [Segal 2013]. A theoretical model has been developed in which non-cognitive traits contribute to the utility function and thus basically work as preferences [Bowles, Gintis, Osborne 2001]. Associations between some preferences and personality traits are intuitively obvious and strong. However, empirical attempts to measure the relationship between economic preferences and psychological characteristics produce dubious findings. Earlier studies found weak correlations between preferences and the Big Five domains [Becker et al. 2012; Daly, Harmon, Delaney 2009; Dohmen et al. 2010], while more recent publications show that such findings could have resulted from measurement error [Jagelka 2020]. Anyway, the question of how individual preferences relate to personality traits is yet to be answered.

1.1. Formation and Stability of Non-Cognitive Skills

Implementation of education policies to promote non-cognitive skills requires understanding how such skills are shaped. One of the theoretical models of skill formation [Cunha, Heckman 2007; 2008] assigns a pivotal role to family investment in children: childhood is conventionally divided into several stages, and the output of skill at each stage is determined by the skill and family input from earlier stages. Model evaluation reveals complementarity of skill investments and shows that non-cognitive skills promote the development of cognitive competencies, but cognitive ability does not affect the formation of non-cognitive characteristics.

Everything that economists know about the process of non-cognitive skill formation and development mostly pertains to childhood and adolescence, i. e. the early educational stages of preschool and secondary school education. Findings from the relatively few publications exploring the effects of higher education on non-cognitive skills indicate that very few skills can still be shaped at later stages of development, such as extraversion and agreeableness. Upward trends exhibited by these domains during the college years is conditioned by an increase in social engagement and cooperation [Kassenboehmer, Leung, Schurer 2018]. However, empirical studies show that these traits are correlated less with academic and job performance than the other Big Five categories [Braakmann 2009].

How skills are shaped has a lot to do with their stability. Non-cognitive skills have to be stable to allow measuring their impact on ac-

ademic and job performance, otherwise the use of personality traits as explanatory variables will cause endogeneity bias. Economists believe that, once formed in adolescence, non-cognitive skills remain stable throughout adulthood [Elkins, Kassenboehmer, Schurer 2017]. Furthermore, a number of empirical studies proceed from an even stronger premise that non-cognitive skills remain stable over a certain period regardless of important life events [Cobb-Clark, Schurer 2012; 2013]. Not only does such a premise take the issue of endogeneity off the table but it also solves the problem of limited data: in the majority of household surveys, non-cognitive characteristics can only be assessed at a particular point in time, which occurs either long before (as with measuring children's non-cognitive characteristics to predict their participation in postsecondary education) or after the dependent variable is measured. Psychologists, on the other hand, are less unanimous in their views on personality stability. Traditionally, personality has been thought to be relatively stable over long periods of time and change essentially little after the age of 30 [Costa, McCrae 1980]. More recent longitudinal studies suggest that change does occur, as respondents provided different answers at different times and under different circumstances [Lucas, Donnellan 2011]. It remains unclear, however, whether the observed change was real or resulted from measurement error.

2. Associations between Non-Cognitive Skills and Higher Education Choice-Making

Higher education choice-making involves at least two consecutive steps: first, decide whether to pursue a college degree or, for example, embark on a vocational track right after secondary school; and second, choose a field of study.

Individuals decide whether or not to pursue higher education based on their own cognitive and non-cognitive characteristics [Heckman, Stixrud, Urzua 2006; Borghans, ter Weel, Weinberg 2008]. Although cognitive factors are extremely powerful predictors of academic outcomes, higher levels of education are associated with lower correlation between intelligence and achievement [Richardson, Abraham, Bond 2012]. Some students struggle despite scoring high on standardized tests, while motivation and effective study strategies can compensate for a lack of cognitive ability in less capable undergraduates [Komarraju, Ramsey, Rinella 2013].

The Big Five domains of conscientiousness and openness to experience are correlated significantly positively—nearly as strongly as intelligence—with going to college. Of all the Big Five categories, conscientiousness is the best predictor of grades, and openness to experience is the most strongly associated with the years of schooling [Borghans, ter Weel, Weinberg 2006]. Conversely, neuroticism is correlated negatively with the intention to go to college [Peter, Storck 2014]. The same is true for extraversion: being associated with greater social activity, it affects negatively the probability of going to college [Humburg 2017].

A non-linear relationship is observed between non-cognitive skills and the level of education [Polemis 2018].

Non-cognitive skills predict not only going to college but also the level of undergraduates' ambitions. The only available economic publication on the correlation between non-cognitive skills and academic ambitions, which are measured by college selectivity, shows that students with lower non-cognitive skills (locus of control and self-concept) are more likely to enroll in less selective colleges given their academic credentials [Saltiel 2020].

The impact of non-cognitive skills on higher education choice-making depends on the socioeconomic environment in which an individual was raised. Evaluating the associations among personality traits, high-school completion, and applying to college, U.S. economist Shelly Lundberg concludes that the effects of the Big Five vary as a function of family characteristics. Openness to experience turns out to be the most important quality in the context of learning as it can compensate for less advantaged backgrounds [Lundberg 2013]. Similar findings were obtained in Germany, where the probability of taking up higher education increases among high-school leavers when they are more emotionally stable and open to experience, the latter being a particularly significant factor for students from non-academic parental homes [Peter, Storck 2014]. First-generation college students tend to perform lower than average at the beginning of their study; high levels of conscientiousness usually compensate for this performance penalty, while very low levels exacerbate it [Edwards et al. 2020].

While cognitive skills are a strong predictor of engagement in post-secondary education, the choice of major is largely influenced by psychological parameters that shape personal interests and aptitudes for specific careers. Choosing a field of study that matches one's interests and aptitudes is associated with better academic outcomes as well as better job performance in the future [Borghans, ter Weel, Weinberg 2008].

The Big Five domains of extraversion, conscientiousness and emotional stability are related to major choice almost as strongly as cognitive skills. Highly conscientious individuals are sorted into the most demanding fields such as Science, Technology, Engineering and Mathematics (STEM) and Medical Sciences [Humburg 2017; Berkes, Peter 2019]. Emotional stability is positively related to the probability of choosing STEM fields and Law as a major, and negatively related with choosing Humanities. Less emotionally stable individuals exhibit higher career indecision. As Humanities have weaker links to particular occupations and careers than STEM fields and Law, the associations found may be the result of individuals' postponing their career decision by choosing Humanities. Higher extraversion is associated with a higher probability of choosing Law and Business and Economics, and a lower probability of choosing a STEM field of study. All other things being equal, Law and Business and Economics seem to fit extroverts

better in terms of the opportunity for social interaction, for persuading others, and for being the focus of attention. Agreeable individuals often enjoy helping others; one might therefore expect that they would have a preference for Medical Sciences, Education, or other fields of study concerned with the functioning of societies. However, this association is not supported by the findings available, although agreeableness decreases the probability of studying Business or Economics. Finally, openness to experience is positively related with choosing Humanities and Law, and negatively related with enrolling in Social Sciences [Humburg 2017; Vedel 2016].

2.1. Gender Gaps in Education: Is It About Psychology?

Men and women demonstrate consistent differences in non-cognitive skills and preferences, which is explicitly manifested in their economic behaviors and is extensively covered in psychological, sociological, and economic literature. Women tend to avoid competition, wage bargaining, risky investment decisions, and competitive compensation schemes [Croson, Gneezy 2009]. Negotiating, risk-taking and choosing competitive environments are associated with a high level of emotional stability and low propensity to cooperate. Women, meanwhile, tend to score high on neuroticism and agreeableness [Bouchard, Loehlin 2001], this trend being robust across countries [Schmitt et al. 2008].

Gender differences in non-cognitive skills begin at preschool age and increase over time [DiPrete, Jennings 2012]. In early childhood, they result to some extent from external influences, including parenting styles, family patterns, environment, society, and cultural beliefs. Later on, the gap widens under the influence of gender-stereotypical expectations bolstered by schools. Already in elementary school, girls are more disciplined and attentive in class than boys [Frenette, Zeman 2007]. At the same time, boys display higher self-esteem, are more prone to risk-taking, and perform better in competitive situations than girls. Differences in the observed non-cognitive skills translate into gender differences in grades, girls showing better academic performance than boys [Jacob 2002].

The higher education choices dimension of gender differences in non-cognitive skills has been little studied. It is known that the majority of college students in developed countries are women. Reasons for this include better school performance and higher school graduation rate among women, which are associated with differences in the level of conscientiousness [Jacob 2002]. A wide gender gap is observed in college major composition [Gemici, Wiswall 2014], men being more likely to major in mathematics, engineering and business fields, and women opting for humanities, teaching and social sciences. Admission test scores explain little to no gender differences in the choice of major. Therefore, the gender gap is mainly due to gender differences in preferences and tastes, and not to differences in academic ability [Zafar 2013]. Neuroticism and self-concept may play an essential role, too. Math self-efficacy raises both men's and women's probability of

enrolling in a STEM major. However, math self-efficacy also plays a critical role in explaining decisions to drop out of STEM majors for women, but not for men [Saltiel 2019].

Since typically "male" majors are mostly associated with higher wages, differences in the field of study account for a significant part of the male-female wage gap [Brown, Corcoran 1997]. By various estimates, the role of non-cognitive skills in the wage gap in Germany varies from 3% [Mueller, Plug 2006] to 13% [Braakmann 2009]. The impact of personality traits on gender wage gaps increases across the wage distribution, yet making allowance for personality does not reduce the unexplained share of wage gaps [Collischon 2018]. That is to say, according to Collischon, effects of non-cognitive characteristics may be ruled out, or "captured", by other control variables like industry and occupation, i. e. the parameters predetermined by the choice of college major.

3. Relevance of Non-Cognitive Skills for Higher Education Policies

Changes in human capital research priorities reflect changes in the political discourse on investments in education. Experts are concerned about the decreasing ability of higher education to meet labor market demands, while employers actively search for general behavioral skills, sometimes rating them above cognitive abilities. There is a legitimate question to be asked, therefore: if non-cognitive skills are so important for social and career outcomes, why not allocate some of the education funding to foster such skills within the framework of formal secondary and higher education? Moreover, standalone experimental projects involving elementary and middle school students indicate effectiveness of educational interventions that target personality skills [Heckman, Jagelka, Kautz 2019]. Along with schools, responsibility for non-cognitive skill formation is also imposed on universities, which have to adjust to the changing economic landscape and teach skills that are in high demand in the labor market. However, while development of non-cognitive skills is justified in school, focusing on them in college makes much less sense. At least three factors casting doubt on the feasibility of investments in non-cognitive skills at the level of higher education have been discussed in economic and psychological literature.

First, a young adult's personality tends to change autonomously. According to psychologists, college years coincide with the developmental stage at which personality is the most susceptible to external influences; however, it is also when positive changes naturally occur: maturation, adoption of adult roles, and experience of responsibility for one's own life increase the levels of conscientiousness, agreeableness, and emotional stability [Roberts, Hill, Davis 2017]. For this reason, researchers believe that it may be more cost-effective to let normative change take its course rather than to intervene in most cases [Bleidorn et al. 2019].

Second, non-cognitive skills have long-term accumulative effects from a socioeconomic perspective. Freshmen's personalities and behaviors, at which educational interventions are targeted, are already a product of school education and social influences. The most vulnerable groups with low non-cognitive skills that need educational interventions in the first place simply never get to universities: if a child was low on conscientiousness throughout their life, the academic implication for them would be choosing a non-selective college or not going to college at all. Therefore, despite prolonged malleability of non-cognitive skills, educational interventions should be implemented as early in life as possible to achieve the best results [Kautz et al. 2014]. Focus should be placed on the Big Five traits that are positively associated with productivity in adult life, such as conscientiousness. Importance of early childhood interventions is also confirmed by studies that reveal stability of conscientiousness all the way through college years [Kassenboehmer, Leung, Schurer 2018].

Finally, changes in personality traits to not occur instantaneously. It takes time to achieve consistent outcomes that will translate into positive social effects—but higher education programs do not have that time. College degrees are much shorter in duration than secondary school programs and involve a regular change of courses and professors that makes it harder to implement a comprehensive intervention to promote non-cognitive skills. Despite all the limitations, it is critical that higher education foster the development of soft skills, which are not identical to non-cognitive characteristics but are related to them. Soft skills are largely about being able to work in a team, interact with others, and adapt to technological change. Although the significance of soft, or general, skills is widely recognized by educational institutions and employers, they rarely or, at the very best, inconsistently happen to be a component of the learning process in higher education. Meanwhile, soft skills are crucial for implementing a competency-based approach to education and transitioning from highly-specialized training to teaching a broad spectrum of skills. College environment is the best for promoting soft skills, which can be taught within short timeframes—unlike non-cognitive skills. Furthermore, a more personalized teacher-student dialogue in higher education, in comparison with other educational stages, allows tailoring teaching styles to students' personality traits. While "reconfiguring" personalities of young adults in the course of college studies would be challenging at the very least, any undergraduate regardless of their personality is able to learn some leadership, workflow management, or negotiation skills. During the period of moving into adulthood, which falls on college years, individuals learn to adjust to the requirements of the outside world. This adjustment does not involve a radical personality change, yet it implies development of skills that allow maintaining adequate job performance irrespective of personality traits. The mission of higher education is to facilitate this process of adaptation.

4. Conclusion

Non-cognitive skills affect economic outcomes through complex mechanisms and are inseparable from other forms of human capital: cognitive skills and educational attainment. This review summarizes findings, mostly from economic studies, on associations between non-cognitive skills and higher education. The results indicate that non-cognitive skills have a significant influence on the probability of going to college, the choice of major, and academic achievement. The observed gender differences in non-cognitive ability predict to some extent self-selection of men and women into different careers, thereby exacerbating the gender wage gap.

Findings obtained in the publications reviewed can have practical implications for education policy, particularly in the context of early childhood development. Although higher education is assigned an important role in promoting skills for future job performance, the present review of literature shows that many of the competencies essential for academic and economic success—those that reflect an individual's capacity for hard work and emotional stability—are shaped long before college.

Empirical analysis of non-cognitive skills is complicated by a number of methodological difficulties, from uncertainty about which instruments should be used for measurement to controversial data on stability of personality traits over time. Nevertheless, non-cognitive skills attract more and more interest from researchers every year. However, because this topic is still a novelty for the Russian-speaking research community, empirical studies have been rather sporadic. The Russian literature still lacks evaluations of how non-cognitive characteristics affect the choice of educational track and academic outcomes in school as well as at later stages of development. A critically important avenue of further research would be to document the process of how non-cognitive skills are formed and remain stable over the course of college years. The impact of non-cognitive characteristics on socioeconomic behavior is a cross-disciplinary problem at the interface of personality psychology, labor economics, and education economics. An effective solution therefore requires integrating the efforts of various social scientists, economists and psychologists in the first place.

Appendix. Table 1. Summary table of empirical economic studies addressing non-cognitive skills in higher education

Authors, year	Country	Subject of research	Non-cognitive traits measured	Data sources and sample size	Findings
Baron, Cobb-Clark 2010	Australia	Probability of going to college	Locus of control	2,065 observations, 18-year-olds	Young people with a more internal locus of control have a higher probability of finishing secondary school and meeting the requirements to obtain a university entrance rank. There is a negative relationship between growing up in disadvantage and educational outcomes, but this effect is not mediated by locus of control
Berkes, Peter 2019	Germany	Higher education choices	The Big Five	Longitudinal survey of 3,615 high school graduates, 2014–2015	High openness to experience is associated with choosing Humanities. Conscientiousness is positively associated with choosing Medical Sciences or Economics as a major. Extraverts are more likely to choose Law, Social Sciences, and Economics, and less likely to enroll in STEM majors
Blázquez, Budría 2012	Germany	Probability of over-education	The Big Five; Locus of control	71,321 observations, 2000–2008	The probability of being overeducated is significantly influenced by personality. Conscientiousness, extraversion, and having an external locus of control decrease the probability of remaining overeducated, while neuroticism, agreeableness, and especially openness increase it
Corazzini et al. 2020	Italy	Influence of personality traits on academic performance	The Big Five	3,242 freshmen students aged 18–24 at a public university, 2016–2017	Higher levels of conscientiousness and openness to experience positively affect student score. No gender-dependent effects of the Big Five on Grade Point Average is found
Delaney, Harmon, Ryan 2013	Ireland	Lecture attendance and additional study hours	The Big Five; Economic preferences (future-orientation, attitude towards risk)	4,770 and 2,867 respondents, 2009	Conscientiousness and future-orientation are important determinants of lecture attendance and additional study hours. Openness to experience is positively associated to additional study hours. Neuroticism and agreeableness are positively related to lecture attendance
Edwards et al. 2020	Australia	Influence of personality traits on academic performance	The Big Five; Locus of control	1,000 students who started their degree in 2015	Conscientiousness and extraversion are strong predictors of academic performance. High levels of conscientiousness over-compensate for the performance penalty experienced by first-in-family students, while very low levels exacerbate it
Humburg 2017	Netherlands	Probability of going to college; Higher education choices	The Big Five	Longitudinal survey of 19,391 individuals who entered secondary education in 1999, drawn from a random selection of 126 schools	Extraverts tend to choose Business, Economics, and law. Agreeableness decreases the probability of studying Business or Economics. Emotional stability is positively related to the probability of choosing STEM fields and Law as a major, and negatively related with choosing Humanities. Conscientiousness is positively related to academic performance and the probability of choosing Medical Sciences. Openness to experience is positively related with choosing Humanities and Law, and negatively related with enrolling in Social Sciences
Kassenboehmer, Leung, Schurer 2018	Australia	Changes in non-cognitive skills during college years	The Big Five	Longitudinal survey of 575 teenagers aged between 15 and 19, 2005–2013	Every additional year at college increases extraversion and agreeableness for students from disadvantaged backgrounds, the effect being the most pronounced in STEM majors
Lenton 2014	UK	Probability of going to college	Locus of control, The Big Five	Longitudinal survey of children born in 1970 1986: 11,622 observations at age 16 2004: 2,483 observations at age 33	Locus of control, conscientiousness, and extraversion have significant influence on the acquisition of educational qualifications. Males with extrovert personalities have a significantly reduced probability of gaining degree level education

Authors, year	Country	Subject of research	Non-cognitive traits measured	Data sources and sample size	Findings
Lundberg 2013	U.S.	Probability of going to college	The Big Five (measured after graduation)	Nationally representative sample of school students surveyed in 1994–1995 and then in 2007–2008, when the respondents were between 24 and 32 years of age. 13,465 observations	The effects of cognitive ability and personality traits on college graduation vary by family background. Conscientiousness has no significant impact on the probability of going to college, while openness to experience is an important correlate of college graduation only for less-advantaged men and women
Peter, Storck 2014	Germany	Probability of deciding to go to college	The Big Five (measured at the moment of decision-making)	1,000 observations, young people aged 17	Intention to study in college is associated positively with openness to experience and emotional stability, and negatively with agreeableness. Openness plays a greater role for high-school students who may be the first in their family to go to college
Piatek, Pinger 2016	Germany	Probability of going to college	Locus of control	2001: 1,901 individuals aged 17–27 2011: 1,606 individuals aged 25–35	Higher locus of control is related to higher probability of obtaining a college degree for men and women
Polemis 2018	U.S.	Level of study	The Big Five	1,660,638 individuals aged between 16 and 60. Cross-sectional data for 2009–2015	A non-linear relationship is observed between non-cognitive skills and the level of education. Individuals with high emotional stability and agreeableness are more eager to invest in human capital. Associations between openness and agreeableness are described by an N-shaped curve; and those between agreeableness and extraversion, by an inverted-U-shaped curve
Saltiel 2020	U.S.	Probability of going to college; College choice	Locus of control; Self-concept; Motivation	1980–1986: 3,167 observations 2002–2012: 4,576 observations	Students with lower non-cognitive skills are more likely to undermatch (enrolling in less selective colleges given their academic credentials). Non-cognitive skills are strong predictors of Bachelor's degree completion

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